

# **EEE 3112 Electrical Engineering Practice**

## **Lecture 3 Operation Procedures**

# 1. Flammable/Combustible Materials

- **Flammable** and **combustible** liquids are liquids that can burn. They are classified, or grouped, as either **flammable** or **combustible** by their flashpoints.
- Generally speaking, **flammable** liquids will ignite (catch fire) and burn easily at normal working temperatures.
- Combustible scrap, debris, and waste should be stored in covered metal receptacles and removed from the work site promptly.
- Proper storage methods should be used to minimize the risk of fire and spontaneous combustion.

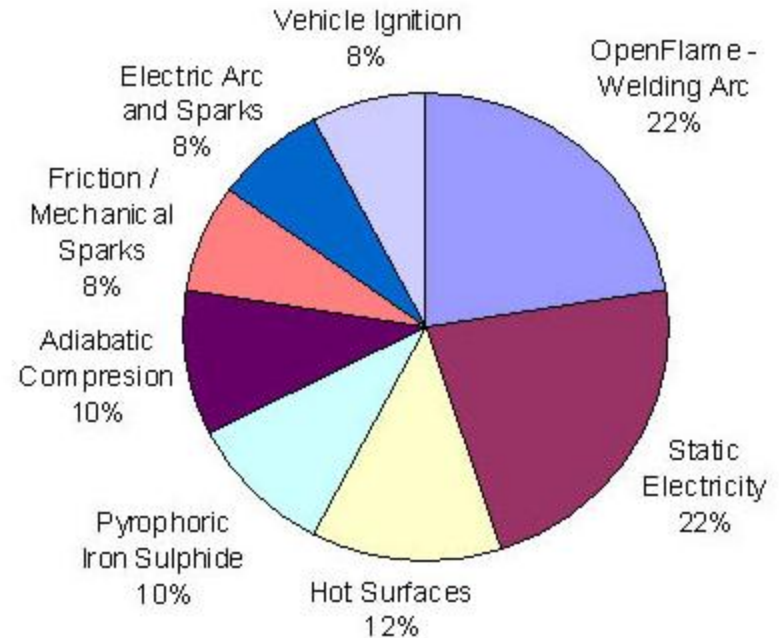
- Approved containers and tanks should be used for the storage and handling of flammable liquids.
- Connections should be tight on all drums and flammable liquid piping (vapor and liquid). All flammable liquids should be kept in closed containers when not in use.
- Bulk drums of flammable liquids should be grounded and bonded to containers during dispensing.
- Storage rooms for flammable liquids should have explosion-proof lights.
- All solvent wastes and flammable liquids should be kept in fire-resistant, covered containers until they are removed from the work site.

- Vacuuming should be used rather than blowing or sweeping combustible dust when possible.
- Fire extinguishers should be provided for the type of materials they will extinguish, and placed in areas where they are to be used.
- Appropriate fire extinguishers should be mounted within 75 feet of outside areas containing flammable liquids, and within 10 feet of any inside storage area for such materials.
- Only trained personnel should transfer or withdraw flammable liquids.
- Employees should be trained in the use of fire extinguishers.
- All extinguishers should be serviced, maintained, and tagged at least yearly.

- All extinguishers should be fully charged and in their designated places. Extinguishers should be free from obstruction or blockage.
- Where sprinkler systems are permanently installed, the nozzle heads should be directed or arranged so that water will not be sprayed into operating electrical switchboards and equipment.
- “NO SMOKING” signs should be posted in areas where flammable or combustible materials are used or stored. Also “NO SMOKING” signs should be posted on tanks of liquefied petroleum gas.
- “NO SMOKING” rules should be enforced in areas involving storage and use of flammable materials.
- Safety cans should be used for dispensing flammable liquids. All spills of flammable or combustible liquids should be cleaned up promptly.

# 1.1 Electrical Ignition Sources

- The best way to prevent fires and flammable vapor explosions, either inside or outside process piping and equipment, is to avoid creating a flammable mixture.
- Inside process equipment, this means controlling the “fuel” and “oxygen” sides of the fire triangle (bottom right).



- We must also prevent the release of flammable or combustible gases, liquids, or dusts (fuel) from process equipment into the surrounding environment, where oxygen will always be present in the air.
- However, we must also recognize that our equipment and operating procedures can fail and a flammable atmosphere can result from a failure.
- So, we must always work to eliminate ignition sources (“heat” in the fire triangle) in any place where there is the potential for a flammable atmosphere.
- The pie chart to the right on the previous slide shows some examples of ignition sources that we need to control.
- Do you have any of these in your plant?

# 1.2 Control of Ignition Hazards

- Understand and strictly follow your plant's work permit procedures for hot work, electrical work, and any other activity that could create ignition sources in hazardous areas.
- Follow your emergency procedures in case of a flammable release. For example, make sure that hot work is stopped and vehicles are shut off.
- Look for potential ignition sources such as faulty electrical wiring, improper equipment in hazardous areas, or other issues as you go about your job. Report problems and make sure they are fixed.
- Understand hazardous area (electrical) classification for your plant .

- Remember that many common portable electronic devices such as cell phones, digital cameras, tablet computers, and laptops are not rated for use in hazardous areas. Follow your plant's policies and permit systems for use of these devices.
- Be aware that a hot surface, such as a hot pipe or a hot motor, can be an ignition source, particularly if you are handling a material with a low auto-ignition temperature.

## 2. Electrical Lockout/Tagout Procedures

- The purpose for these procedures is to provide a minimum standard by which qualified persons must isolate all potential energy sources before electrical work can be performed.
- This applies to all employees, contractors or other persons doing electrical work at a company location.

## 2.1 Policy Requirements

- **Identify** the specific equipment or component to be isolated.
- **Locate** the isolation device and compare the equipment identification number to assure that the two are a match.
- **Inform** everyone in the immediate work area of your intentions and make sure they are moved to a safe location.
- **De-energize/Deactivate** all potentially hazardous electrical energy sources and/or block against unexpected movement or release of stored energy.

- **Lockout and Tagout** — Each person performing electrical work on that equipment must verify the circuit is de-energized and they must install their own personal lock and tag on the multi-lock tree or group lock box.
- **Test** - attempt to operate the piece of equipment or component to verify that it has been properly isolated and/or immobilized.
- ✓ Use the proper device (Voltmeter depending upon the Voltage) to test for absence of voltage. (Verify proper instrument operation before and after testing.)
- ✓ Do an assessment to make sure that all possible hazards have been accounted for and mitigated.
- **Perform** the work safely. Follow site specific Safe Work Procedures where available.

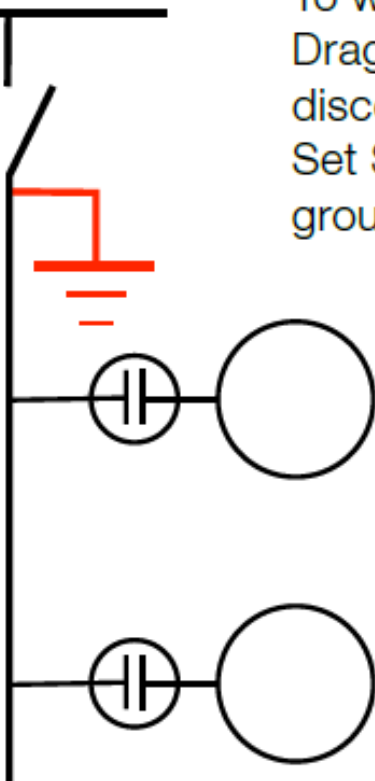
- **Notify** all affected persons when the work has been completed and let them know that you intend to re-energize the equipment or component.
- **Remove** your lock and tag when;
  - the work has been completed and the equipment has been inspected to assure that it is safe to test or be returned to duty.
  - all tools, restraints and testing devices have been removed and properly stored, as well as any parts, lubricants and other materials have been removed and stored.
  - all persons have been cleared from the immediate area and machine guards, where applicable have been replaced. The only exception to this requirement is when:

- the equipment must be energized for troubleshooting or adjusting purposes. This work must be done following very strict procedures which shall be well communicated before the work is started.
- Individual employee locks will be replaced by a community lock at the end of the work shift. The community lock key will be transferred to the current or on-coming shift supervisor or to the qualified person responsible for the work on the on-coming shift.
- **Restore Power** — when all repair work is completed and all persons are positioned safely.
- Notify all personnel involved with the job or task that the lockout/tagout is complete, that the electrical supply is being restored, and to remain clear of the equipment and electrical supply.

## Example: Procedure for Dragline and Shovel MG Sets

6900 volts

OCK



To work on MG Sets or DC Motors on a Dragline or Shovel, open and lock the visible disconnect that removes power from the MG Set Stator or Drive isolation Transformer then ground the load side of the switch.

Open and Lock the visible disconnect or Breaker that feeds power to the Generator Field Exciter.


If Static Motor Fields or Space Heaters are used in the motors, open and lock the breakers feeding those circuits as well.

## 2.2 Lockout/Tagout Individual Card Template

- This card should be used in conjunction with a Lockout/Tagout Tag which will describe the reason that the equipment is de-energized.
- The card should also be signed by the employee before it is laminated.

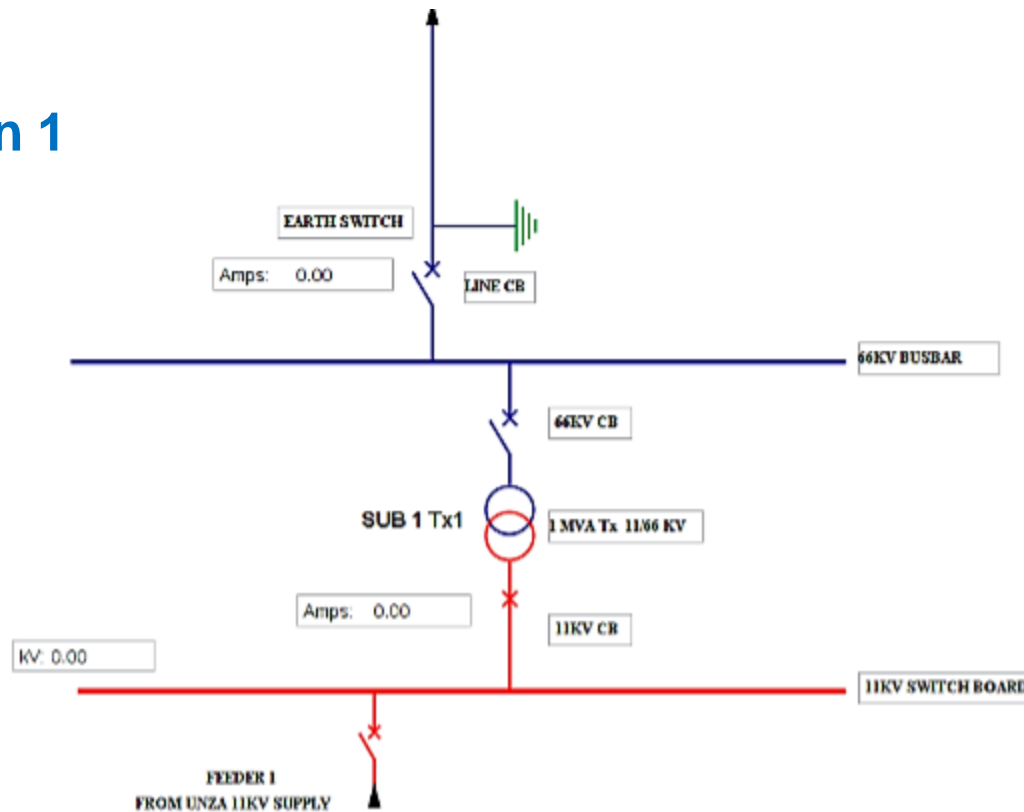
(Individual Electrical Tag)

|                      |
|----------------------|
| <b>DANGER</b>        |
| DO<br>NOT<br>OPERATE |
| J. Sunkutu           |
| Date:                |

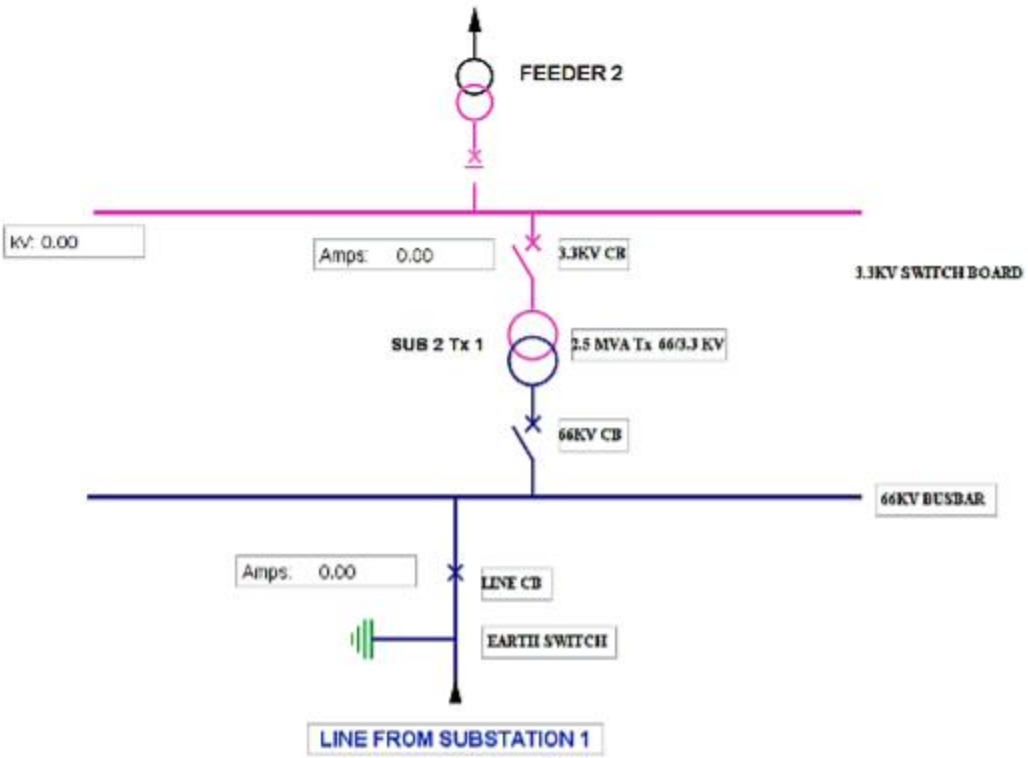
|  |
|--|
| <b>DANGER</b>  |
| DO NOT REMOVE<br>THIS TAG  |
|  |
| SEE OTHER SIDE   |

# 2.3 Switching Procedure for Unza Substation

## Substation 1



# Substation 2



- Switching involves linking and delinking. Delinking simply means opening of the isolators.
- Switching and Earthing instructions are given separately (CEC practice).
- **Considering the load:**
  - ✓ When switching off, start with the LV side.
  - ✓ When switching on, start with the HV side.

- **NOTE: Familiarize with the following equipment:**

(1) 66 kV OCB (2) 11 kV OCB (3) 3.3 kV OCB (4) 11/66 kV Transformer  
(5) 66/3.3 kV Transformer (6) 3.3/0.4 kV Transformer (7) Surge Arresters  
and (8) Insulators

**End of Lecture!**